Space Weather Technical Forecast

Issued on Sunday 2 March 2025 at 12:28 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1/G2 late Tuesday 04 March and into UTC midweek. Active 24-hour electron fluence becoming Likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity measured at GOES16 and 18 has been Low, with a peak flare of C9.6 at 01/2301UTC from the southeastern limb. This was possibly tied to a returning region in the vicinity, generating a CME off the Sun-Earth line.

The solar disc now features up to eleven regions, with five new minor, unnumbered regions emerging, primarily in the east. Magnetically, most regions remain relatively simple; however, the three main active groups have undergone the most notable changes. In the northwest, AR4006 showed some slight enhancement to its intermediate spots. In the southwest, AR4007 saw development and consolidation amongst its leading spots, as well as some slight development to its trailing and intermediate spots. Finally, AR4009 showed little overall change but did see an emergence of a NEW group just to its north.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by ACE at L1, are indicative to a waning connection to a strong positive coronal hole fast wind (CH19/+).

Solar wind speeds have been on a declining trend, gradually waning from strong levels near 700km/s to end the 24 hours at elevated levels near 500km/s. The solar wind density was below average levels. The IMF was weak, below 6nT throughout, while the north-south component was erratic between +5/-4nT. The phi angle was largely positive (away from the Sun).

The net result of the above solar wind measures was Quiet to unsettled geomagnetic activity.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 was at Background levels.

High energy electron flux was at Normal Background to Moderate levels, with a peak of 618pfu at 01/1745UTC. The 24-hour fluence was below the Active threshold (1e8 integrated pfu), but on a rising trend, recording 1.89e7 integrated pfu at 01/2359UTC.

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Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity carries a daily Chance of becoming Moderate, with isolated M-class flares. This may rise slightly into the start of the new UTC week as regions return over the eastern limb.

Solar Wind / Geomagnetic Activity: A CME from the 01/1730UTC filament eruption from the southeast disc may affect Earth as a glancing blow around 04/1900UTC.

Otherwise, fast wind influence from CH19/+ is expected to now wane, with Strong winds gradually and erratically easing to Background.

Geomagnetic activity is expected to be mostly Quiet to Unsettled (Kp1-3), with isolated active (Kp 4) intervals initially. This is until later on Day 3 (04 Mar) where the aforementioned CME brings a Chance of G1 (Kp5) to end this UTC day and on into midweek UTC, with a Slight Chance of G2 (Kp6).

Energetic Particles / Solar Radiation: High energy proton flux is likely to be at Background levels.

High energy electron flux is likely to increase during this period. The associated 24-hour fluence also has the potential to rise, Likely breaching the Active (1e8 integrated pfu) threshold through Day 2 (Monday 03 March). The 01/1730UTC CME reduces confidence by midweek UTC, with a Chance of Active fluence surviving.

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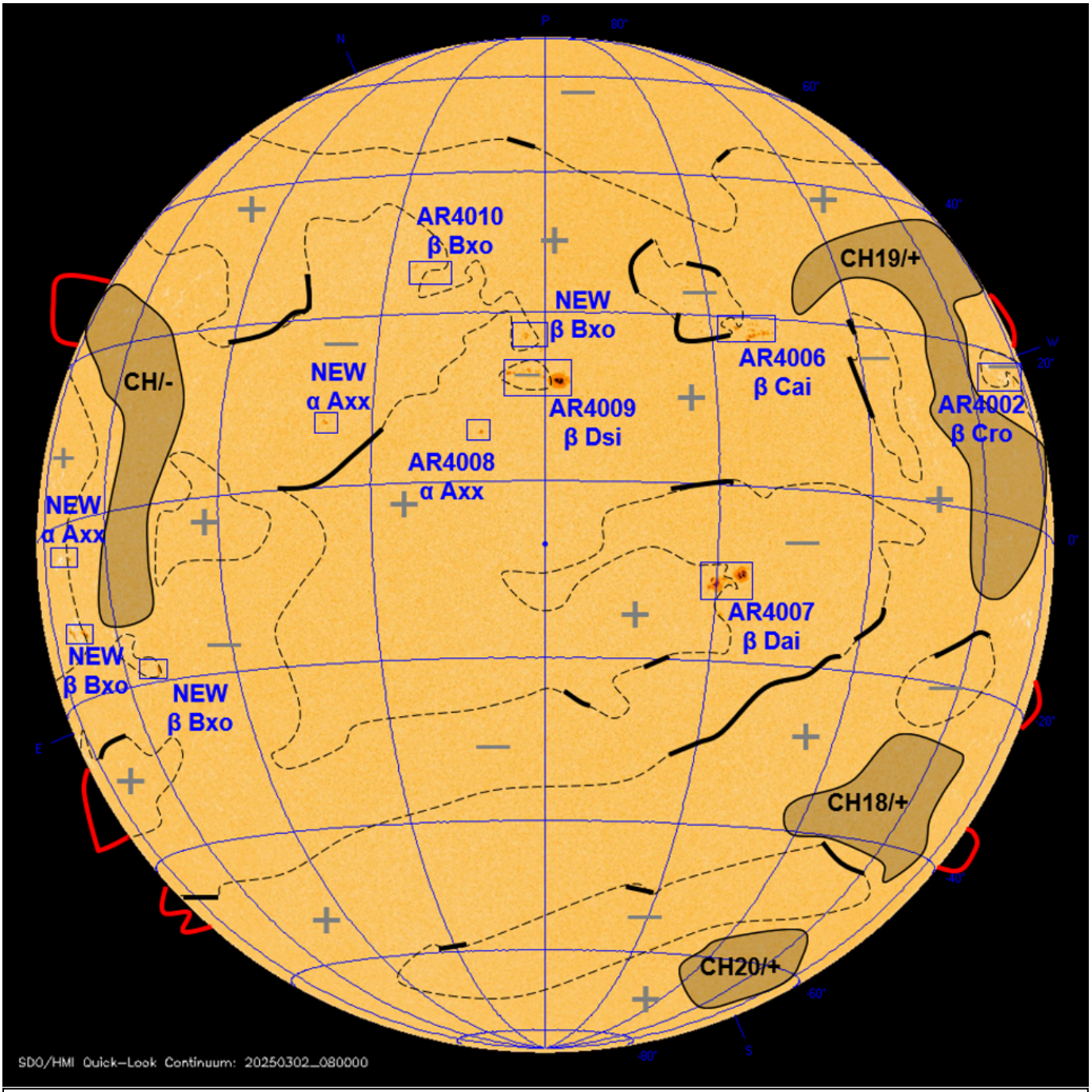
Figure 1: MOSWOC solar synoptic map, valid 02/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

A CME from the 01/1730UTC filament eruption from the southeast disc may affect Earth as a glancing blow around 04/1900UTC, although it appears the majority of the ejecta is south of the Sun-Earth line.

In addition to the above the otherwise ongoing fast wind influence from CH19/+ is expected to now wane, with Strong winds gradually and erratically easing to Background. No further coronal holes are expected to feature in the forecast period.

Geomagnetic activity is expected to be mostly Quiet to Unsettled (Kp1-3), with isolated active (Kp 4) intervals initially. This is until later on Day 3 (04 Mar) where the aforementioned CME brings a Chance of G1 (Kp5) to end this UTC day and on into midweek UTC. There is a Slight Chance this may reach G2 (Kp6) given the nature of the eruption.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	20	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
02/0154UTC	Partial?	Filament eruption	SE quadrant	550	Late UTC day Tuesday 04 March, around 04/1900UTC.	Undergoing further assessment, detail subject to change. Glancing blow.

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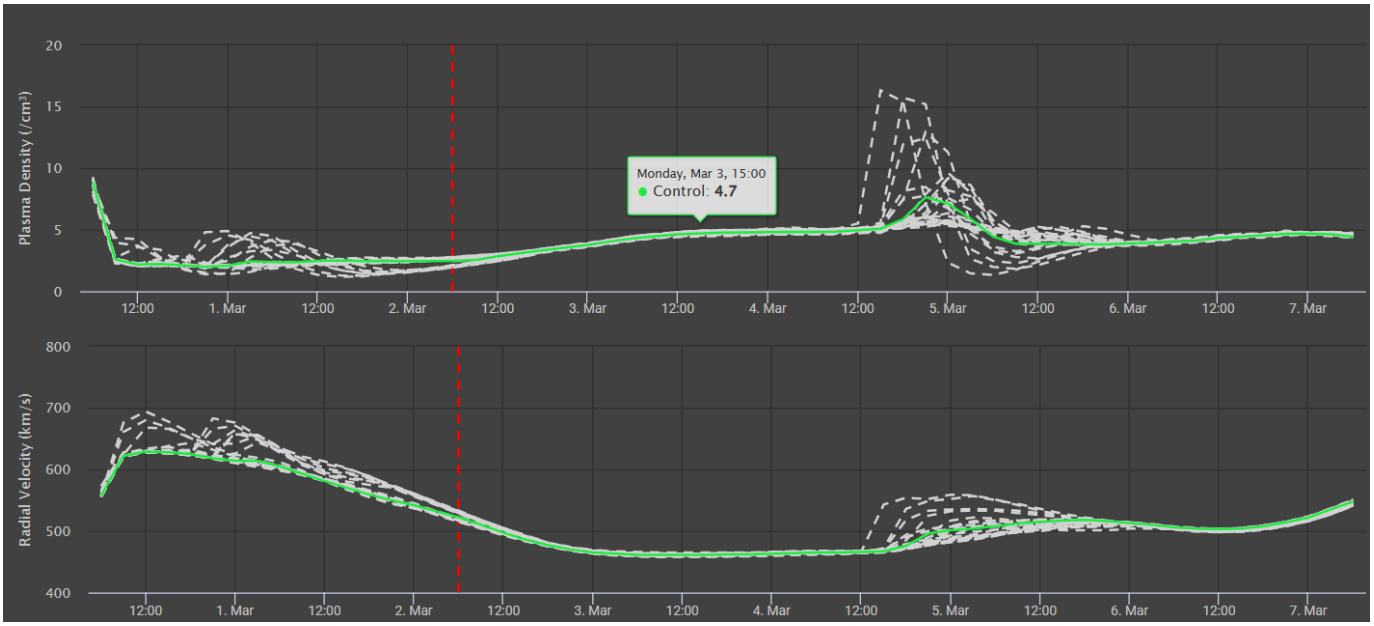
Figure 2: Latest MOSWOC Enlil model ensembles showing glancing blow risk late on the 04 March.



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Radio Blackouts - X-Ray Flares

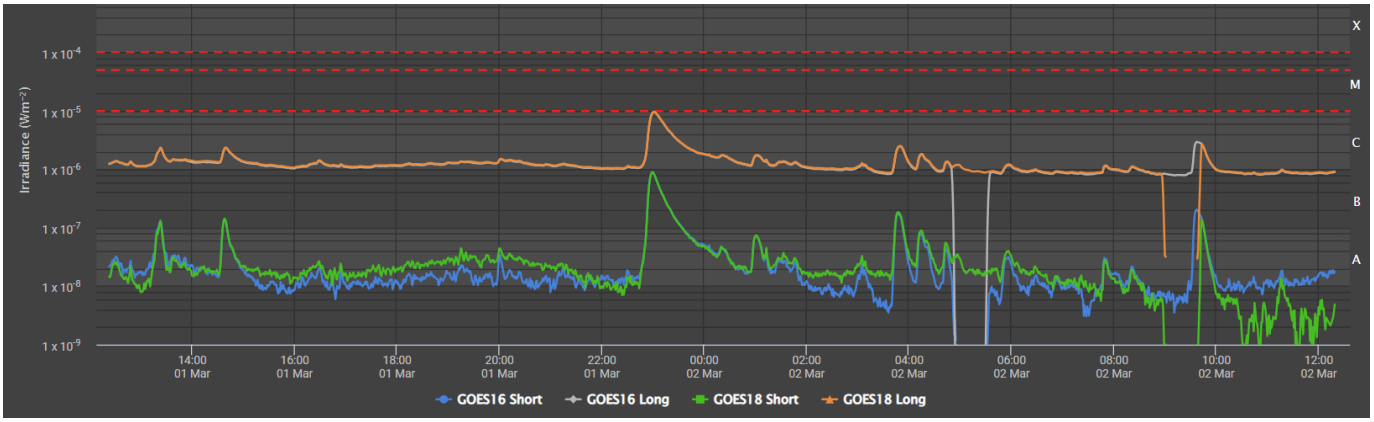
The complexity of the current Earth-facing disc is currently relatively low, and although there are currently up to eleven sunspot regions, these are for the most part simple dipoles or else Zurich Axx groups. The main regions to watch are perhaps AR4006 in the northwest given its habit of launching jet-like emissions north of the Sun-Earth line, although none has yet resulted in any obviously Earth-directed component. The other main active region on the facing side is perhaps AR4009 in the northeast, which saw some areal growth in the past 24 hours.

In terms of the evolution of the forecast, no significant regions leave the disc in the period, while there are up to three returning Carrington regions due over the eastern limb into the new UTC week. One of these was responsible for the peak flare of the past 24 hours and may be the dominant consideration into the new week.

Overall, there is a slightly rising Chance of M-class flares in the period, near the raw value for the disc as it stands.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	40	50	50	50
Very Active	R3-R5 (X Class)	No	1	1	1	1

Figure 3: GOES 16/18 X-ray trace.



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Solar Radiation Storms (High Energy Protons)

GOES18 high energy (>10MeV) proton flux is at Background, and expected to remain at this level. There is a slight chance of enhancement given any significant eruption from the sunspot regions currently on the Earth-facing disc, very gradually increasing towards midweek UTC.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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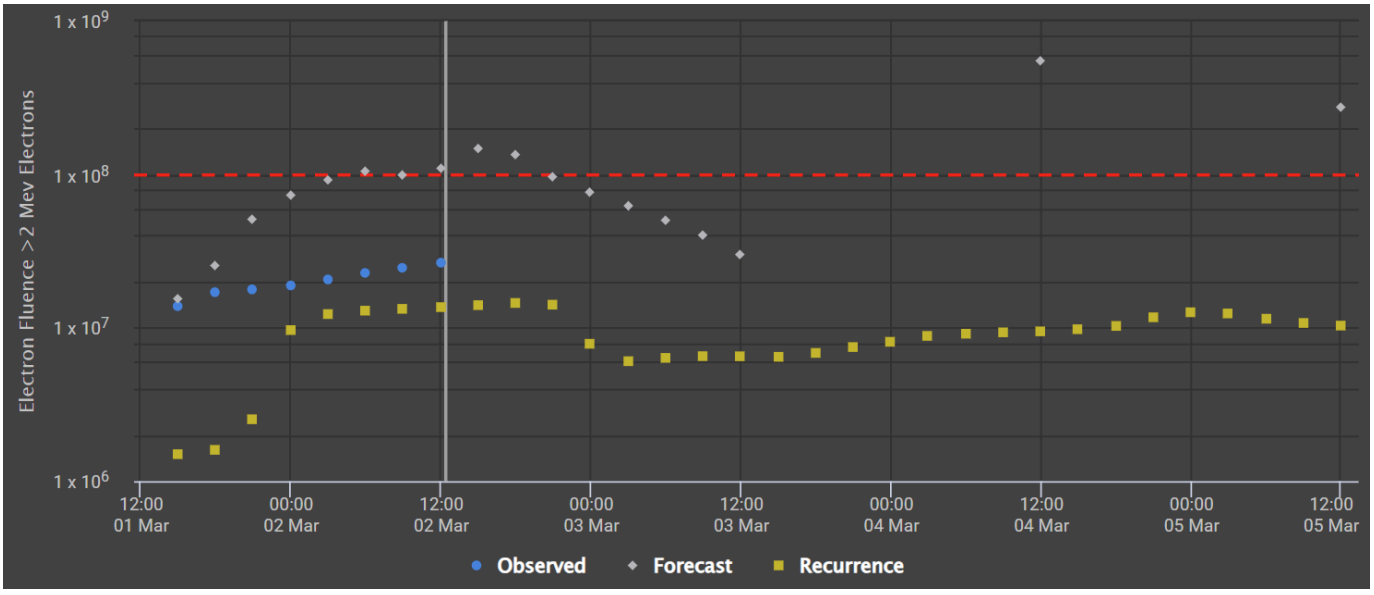
High Energy Electrons (≥ 2MeV)

The high energy electron flux (>2MeV), as observed at GOES16, has risen from Background to give a period of Moderate flux. This was due to the recent charging of the outer Van Allen Belt from the fast wind enhancement from CH18/+. Subsequently, this rising trend is expected to continue through until Tuesday 04 March, as the Strong solar winds and the peak electron flux through the Belt expands outwards towards GEO. Previously suggested persistent High flux becomes less certain into midweek UTC as a result of possible influence of the 01/1730UTC filament CME which may cause electron redistribution and falls of flux at GEO.

The associated 24-hour fluence should see a rising trend, Likely rising above the Active level by the end of day 2 or day 3 (Monday 03 into Tuesday 04 March). This rising trend is supported by MOSWOC REFM, although this is too quick with the predicted enhancement, and overestimating the likely value. The evolution into day four, Wednesday 05 March is now lower confidence, being both beyond the MOSWOC REFM's range and polluted by potential CME influence, but carries a Chance of persisting should the CME be delayed or miss.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	20	60	70	40
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	5	10	5

Figure 4: Latest MOSWOC REFM



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